AUTO-PROVISIONING FOR A VOICE OVER IP GATEWAY

Field

The present inventive subject matter relates to the telecommunications arts. Particular application is found in conjunction with Internet Protocol (IP) telephony, and the specification makes particular reference thereto. However, it is to be appreciated that aspects of the present inventive subject matter are

5 also amenable to other like applications.

Background

It is a common practice to use packet-switched networks, such as IP networks, to connect calls (e.g., voice, data or multimedia calls) between end users. For example, Voice over IP (VoIP) has been developed to permit

10 Consumer Premises Equipment (CPE), such as IP telephones, to be connected over an IP network so that end users may exchange voice communications via the connected CPE. Moreover, IP gateways have been developed that bridge IP networks with the Public Switch Telephone Network (PSTN), a circuit-switched network as opposed to a packet-switched network. That is to say, an

15 IP gateway acts as a point of entry for IP calls into the PSTN, e.g., via a telephone switch such as a class 5 switch, and vice versa for calls from the PSTN into the IP network.

Commonly, IP gateways take advantage of the class 5 switch's features to perform call processing, e.g., routing calls. Consider for example, with

20 reference to FIGURE 1, a call placed to an IP telephone 10 (i.e., the called party) from a telephone 12 (i.e., the calling party) serviced by the PSTN 20. The call is first routed over the PSTN 20 to a terminating telecommunications switch, such as a class 5 switch 22 or the like. From the switch 22, the call is routed over an IP network 30 in a VoIP format. An IP gateway 32 receives the

call from the switch **22**, performs the appropriate conversions to route the call between the circuit-switched and packet-switched networks, and routes the call over the IP network **30** to the IP telephone **10** to complete the connection. While generally the call may in practice be placed from any CPE (including other IP telephones), for the purposes of this example, the calling party is assumed to be using the telephone **12**. Furthermore, it is to be appreciated that there is likely a plurality of IP telephones that are situated similar to the IP telephone **10** and served by the gateway **32**.

It is to be appreciated, as is commonly the case, that when placing the call to the IP telephone **10**, the calling party simply dials a directory number (DN) with the telephone **12** in the usual manner. In this case, for example, the DN for the IP telephone **10** is 555-1234. However, the IP telephone **10** is typically identified within the IP network **30** by an IP address. Accordingly, the switch **22** and the gateway **32** have to be provisioned to associate corresponding IP addresses with their appropriate DNs. As is known in the art, the provisioning of the switch **22** is typically carried out via an operations support system (OSS) **40**.

With respect to the provisioning of the gateway **32**, programming the associations into the gateway **32** is a significant undertaking since every one of typically thousands of such associations has to be specified. For this reason, manual techniques are often not practical for provisioning the gateway **32**. On the other hand, provisioning the gateway **32** via the OSS **40** (as shown in FIGURE **1**) can mean making considerable changes to a service provider's operation systems and/or customizing the OSS **40** beyond the capability already in place to provision the switch **22**. Such a proposition may be deemed undesirable due to the attendant expenses. Moreover, provisioning the gateway **32** is further complicated as additional CPE (e.g., IP telephones) to be served by the gateway **32** are add or installed, or current CPE served by the gateway **32** are removed or uninstalled.

Accordingly, a new and improved system, gateway and/or technique for provisioning the same is disclosed that overcomes the above-referenced problems and others.

Summary

In accordance with one preferred embodiment, a method of provisioning a gateway is provided in a telecommunications network including a circuit-switched network and a packet-switched network. The gateway bridges calls between the circuit-switched network and the packet-switched network. The method includes: receiving a registration message from consumer premises equipment (CPE), the message including an address for the CPE on the packet-switched network; determining a directory number (DN) for the CPE; placing a probe call to the determined DN over the circuit-switched network; receiving a call from the circuit-switched network, the call being terminated at a call reference value (CRV); recognizing the received call received from the circuit-switched network as the probe call; capturing the CRV at which the probe call is terminated; and, associating the captured CRV with the address for the CPE.

In accordance with another preferred embodiment, a gateway is provided in a telecommunications network including a circuit-switched network and a packet-switched network. The gateway bridges calls between the circuit-switched network and the packet-switched network. The gateway includes: registration means for registering consumer premises equipment (CPE) with the gateway by receiving over the packet-switched network a registration message from the CPE, the registration message including an address for the CPE on the packet-switched network; obtaining means for obtaining a directory number (DN) for the CPE; calling means for placing a probe call to the obtained DN over the circuit-switched network; reception means for receiving a call from the circuit-switched network, the call being terminated at a call reference value (CRV); recognition means for recognizing the call received by the reception means as the probe call; means for capturing the CRV at which the probe call is terminated; and, means for associating the captured CRV with the address for the CPE.

In accordance with yet another preferred embodiment, a gateway is provided for bridging calls between a circuit-switched network and a packet-switched network. The gateway serves a plurality of consumer premises equipment (CPE) having addresses on the packet-switched network and the

gateway is operatively connected to the circuit-switched network via a telecommunications switch that is part of the circuit switched network. The gateway includes: a database that relates a plurality of call reference values (CRV) to associated addresses of the CPE served by the gateway; registration means for registering CPE with the gateway by receiving over the packet-switched network registration messages from the CPE, the registration messages including addresses for the CPE on the packet-switched network; and, provisioning means for automatically building and maintaining the database. The provisioning acting to: obtain directory numbers (DNs) for the CPE; place probe calls to the obtained DNs over the circuit-switched network, each of the probe calls being routed by the telecommunications switch to be terminated on the gateway at a call reference value (CRV); detect if calls incoming from the telecommunication switch are probe calls; capture the CRVs at which detected probe calls are terminated; and, associate the captured CRVs with the addresses for the CPE, the associated CRVs and addresses being stored and maintained in the database.

Numerous advantages and benefits of the inventive subject matter disclosed herein will become apparent to those of ordinary skill in the art upon reading and understanding the present specification.

Brief Description of the Drawings

Preferred embodiments may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating preferred embodiments and are not to be construed as limiting. Further, it is to be appreciated that the drawings are not to scale.

FIGURE 1 is a block diagram showing a conventional telecommunications system employing a VoIP gateway.

FIGURE 2 is a block diagram showing a telecommunications system including an IP gateway in accordance with an exemplary embodiment of the same.

FIGURE **3** is a flow chart showing a process for automatically provisioning an IP gateway in accordance with an exemplary embodiment of the process.

Detailed Description of Preferred Embodiments

5   For clarity and simplicity, the present specification shall refer to structural and/or functional network elements, entities and/or facilities, relevant communications standards, protocols and/or services, and other components that are commonly known in the telecommunications art without further detailed explanation as to their configuration or operation except to the extent they have

10   been modified or altered in accordance with and/or to accommodate the preferred embodiment(s) presented.

FIGURE **2** shows an exemplary telecommunications system in accordance with a preferred embodiment of the same, including CPE **60** and **62**, an IP network **70**, an IP gateway **80**, a PSTN **90**, and a telecommunications

15   switch **92**. It is to be appreciated that while the network **70** and gateway **80** have been referred to as an IP network and IP gateway, the network **70** and/or gateway **80** may be of any suitable packet-switched type. For illustrative purposes, CPE **60** is shown as an IP telephone, e.g., used to conduct a VoIP call. However, it is to be appreciated that the CPE **60** may be any appropriate

20   type of CPE as is known in the art for conducting various types of IP or packet-switch calls, e.g., voice, data, multimedia, etc. Similarly, the CPE **62** is shown as a telephone. However, it is to be appreciated that the CPE **62** may also be any appropriate type of CPE as is known in the art for conducting various types of circuit-switched calls. Further, it is to be appreciated that while only the one

25   particular CPE (i.e., CPE **60**) is shown, a plurality of such CPE may be similarly situated and served by the gateway **80**. Also, for simplicity and clarity, only a single switch **92**, a single gateway **80** and a single CPE **62** have been shown in FIGURE **2**. It is to be appreciated, however, that a plurality of similarly situated network elements operating in like manner optionally exist within the system.

30   As shown, the CPE **60** is operatively connected to the IP network **70**, or another like packet-switched network, and the CPE **62** is operatively connected to the PSTN **90**, so that end users employing the same may exchange

communications with one another. The IP gateway **80** bridges the IP network **70** with the PSTN **90**. That is to say, the IP gateway **80** acts as a point of entry for packet-switched calls from the IP network **70** headed into the PSTN **90**, and similarly acts as a point of entry for circuit-switched calls from the PSTN **90**

5   headed into the IP network **70**. In the usual manner, the IP gateway **80** selectively converts and/or translates packet-switched calls into circuit-switched calls and vice versa depending on the direction of traffic flow.

Suitably, the telecommunications switch **92** (e.g., a class 5 switch or the like) on the PSTN side of the IP gateway **80** interfaces with the IP gateway **80**,

10   e.g., via a GR-303 interface **94**, or another like interface such as a V.5.2 interface. Use of the GR-303 interface **94**, the V.5.2 interface or the like, is advantageous insomuch as from the perspective of the switch **92** the IP gateway **80** acts and/or otherwise appears as a remote digital terminal (RDT) while continuing to appear from the IP side as a gateway into the PSTN **90**.

15   The switch **92** is responsible for call routing and optionally provides other call processing and/or call features normally associated therewith. Suitably, the switch **92** is provisioned in the usual manner, e.g., via OSS **96**.

A normal operation of the system shall now be described by way of reference to an exemplary voice call placed from the CPE **62** (i.e., the calling

20   party) to the CPE **60** (i.e., the called party) which is served by the gateway **80**. For purposes of this example, it is assumed that the respective network elements (i.e., the switch **92**, the gateway **80**, and the CPE **60**) have already been properly provisioned. While generally the call may in practice be placed from any CPE (including other IP telephones), for the purposes of this example,

25   the calling party is assumed to be using the CPE **62**.

The calling party initiates the call by using CPE **62** in the usual manner by dialling the DN of the CPE **60**. In this case, for example, the DN for the CPE **60** is 555-4321. Given that the proper provisioning has already taken place, the DN is associated with a particular switch within the PSTN **90** (namely, in this

30   case, the switch **92** that serves the gateway **80**) and an interface group and a call reference value (CRV) for an interface within that particular switch (namely, in this case, the interface **94** that provides the interface between the switch **92** and the gateway **80**). Accordingly, the call is first routed over the PSTN **90** to

the appropriate switch **92**, more specifically, to the interface group of the interface **94** that provides the interface with the gateway **80**.

The switch **92**, via interface **94**, then terminates the call on the gateway **80** at the designated CRV where the gateway **80** picks up the call. Again,

5   assuming that the gateway **80** is properly provisioned, the CRV is associated with a particular IP address, for example, in a database (DB) **82**. Note, provisioning the gateway **80** essentially involves assigning the CRVs to, or otherwise associating them with, the IP addresses served by the gateway **80**, i.e., building the database **82**, as will be described in more detail elsewhere.

10   The gateway **80** then performs the appropriate translating, converting, packetizing, etc., to route the call between the circuit-switch and packet-switched networks. Finally, having identified the corresponding IP address associated with the CRV from which the call was picked up, the call is routed from the gateway **80** over the IP network **70** (e.g., using a VoIP format) to the

15   appropriate IP address, namely, in this case, the IP address corresponding to the CPE **60**. In this manner, connection of the call is completed.

As shown in FIGURE **2**, the gateway **80** is provisioned with and/or supports an automatic provisioning resource (APR) **84** that carries out and/or administers automatic provisioning of the gateway **80**. Suitably, the APR **84** is

20   designated a maintenance number (MN) assigned for the purpose of auto-provisioning the gateway **80**. Furthermore, the APR **84** is equipped to, or is otherwise capable of, placing calls over a separate maintenance CRV associated with the MN, and is also optionally equipped to, or otherwise capable of, receiving calls directed to the MN.

25   FIGURE **3** shows a process and/or method by which an IP gateway is automatically provisioned in accordance with an exemplary embodiment of the same. To better understand the process and/or method, an exemplary provisioning of the IP gateway **80** shall now be described with reference to the installation of the CPE **60**. For illustrative purposes, only the installation of one

30   particular CPE (i.e., CPE **60**) is described. However, it is to be appreciated that a plurality of similarly situated CPEs may likewise be installed and the gateway **80** provisioned accordingly.

The process begins at start step **100** with the installation of the CPE **60**. Preferably, the CPE **60** is provisioned with its own IP address and an alias, as is known in the art. By convention, many service providers include the DN as part of the alias; however, this is not always the case.

5   At step **102**, the CPE **60** sends a registration message to the gateway **80**. The registration message takes the form of a data message or IP message including the CPE's alias and IP address on the IP network **70**. Generally, the registration message is sent by the CPE **60** autonomously to the gateway **80** when the CPE **60** has itself been provisioned and is able to contact the

10   gateway **80**. In this manner, the CPE **60** is registered with the gateway **80**.

Next, at step **104**, the DB **82** is queried or checked by the APR **84** to see if the IP address in the registration message received by the gateway **80** is already associated with a CRV.

If, at decision step **106**, it is determined that the received IP address is in

15   fact already associated with a CRV, then the gateway **80** has already been provisioned to serve the CPE **60**. Accordingly, the registration message is deemed not to correspond to a provisioning request and it is consequently otherwise processed in the usual manner at step **108** (i.e., as registration messages are routinely handled), and the process then flows to the end step

20   **200**.

On the other hand, if, at decision step **106**, it is determined that the received IP address is not already associated with a CRV, then the gateway **80** is not yet provisioned to serve the CPE **60**. Accordingly, the registration message is deemed to correspond to a provisioning request and therefore the

25   process flows to step **110** so that the gateway **80** will be automatically provisioned accordingly.

Upon recognition of a provisioning request, the APR **84** is activated to automatically provision the gateway **80** with respect to the CPE **60**.

At step **110**, the DN for the CPE **60** is determined by the APR **84**.

30   Suitably, the alias obtained from the registration message is examined to see if the DN is included therein. When available, the DN is extracted from the alias transmitted along with the registration message received by the gateway **80** in step **102**. Alternately, if the alias does not include the DN, the APR **84** prompts

the CPE **60** to provide the DN for the CPE **60**. Optionally, the CPE **60** may be provisioned with its own DN that is then automatically returned in a DN identification call or pseudo-call placed to the MN in response to the prompt. Alternately, the prompt takes the form of a tone or other cue sent to the CPE

5   **60**, which would inform a end user or installer to manually enter the DN for the CPE **60**, the manually entered DN then being provided in the DN identification call placed to the MN. In former case (i.e., when the alias provisioned in the CPE **60** includes the DN for the CPE **60**), the DN for the CPE **60** is automatically obtained (via the alias) when the CPE **60** is registered with the

10   gateway **80**. In the latter case (i.e., when the alias provisioned in the CPE **60** does not include the DN for the CPE **60**), the DN for the CPE **60** is obtained when the DN identification call is placed to the MN. In either case, the DN (in one form or another) and the IP address for the CPE **60** are both made available to the APR **84**.

15   At step **112**, the APR **84** places a probe call to the DN determined from step **110**. The probe call determines the identity of the particular CRV that is to be associated with the IP address of the CPE **60**, i.e., the IP address obtained in step **102**. More specifically, the probe call is passed to the switch **92** via the interface **94**. Provided the switch **92** is properly provisioned (i.e., the switch **92**

20   accurately associates the called DN with the corresponding interface group and CRV designated for that DN in the interface **94**), the switch **92** will terminate the probe call on the gateway **80** at the CRV designated for the DN, although the CRV will not currently be associated by the gateway **80** with an IP address.

At step **114**, the gateway **80** monitors and/or checks incoming calls from

25   the PSTN side (i.e., from the switch **92**) to detect and/or identify probe calls. That is to say, the probe calls are distinguished from ordinary calls (i.e., non-probe calls) passing through the gateway **80** in the normal course of events. Various techniques are optionally employed to identify a probe call. For example, the APR **84** optionally marks or otherwise tags the probe call with a

30   detectable signal or data that identifies it as such when the probe call is placed by the APR **84**. Alternately, as shown in FIGURE **3**, caller identification (ID) is employed to identify the probe call. That is to say, caller ID is used to obtain the number from which a call originates.

At decision step **116**, it is determined if the caller ID is equal to or otherwise identifies the MN. If the caller ID does not equal the MN, then the call is recognized as not being the probe call insomuch as it did not originate from the APR **84**. In this case, the process flows back to step **108** and continues

5 accordingly. That is to say, the call is handled in the usual manner (e.g., connecting to the called party) and the process ends.

On the other hand, if, at decision step **116**, it is determined that the caller ID does in fact equal the MN, then the call is recognized as the probe call insomuch as it did originate from the APR **84**. In this case, the process

10 continues on to step **118** to complete the provisioning of the gateway **80**. At step **118**, the CRV, through which the probe call is picked up by the gateway **80**, is captured. The captured CRV is associated with the IP address obtained in step **102** (i.e., the IP address for the CPE **60**), and the DB **82** is updated accordingly, at step **120**. That is to say, the CRV and IP address are stored in

15 the DB **82** so as to reference or relate one to the other. Having completed provisioning of the gateway **80** with respect to the CPE **60**, the process then continues to end step **200**.

As will be appreciate by those of ordinary skill in the art, each of the CPE served by the gateway **80** are similarly handled. In this manner, the DB **82** is

20 built and the gateway **80** is automatically provisioned for all the CPE it serves. Essentially, the approach taken provides for automatic provisioning of the gateway **80** by allowing the gateway **80** to discover its own line provisioning information based upon the provisioning already contained within the CPE and the PSTN.

25 It is to be appreciated that in connection with the particular exemplary embodiments presented herein certain structural and/or function features are described as being incorporated in defined elements and/or components. However, it is contemplated that these features may, to the same or similar benefit, also likewise be incorporated in other elements and/or components

30 where appropriate. It is also to be appreciated that different aspects of the exemplary embodiments may be selectively employed as appropriate to achieve other alternate embodiments suited for desired applications, the other

alternate embodiments thereby realizing the respective advantages of the aspects incorporated therein.

5 It is also to be appreciated that particular elements or components described herein may have their functionality suitably implemented via hardware, software, firmware or a combination thereof. Additionally, it is to be appreciated that certain elements described herein as incorporated together may under suitable circumstances be stand-alone elements or otherwise divided. Similarly, a plurality of particular functions described as being carried out by one particular element may be carried out by a plurality of distinct

10 elements acting independently to carry out individual functions, or certain individual functions may be split-up and carried out by a plurality of distinct elements acting in concert. Alternately, some elements or components otherwise described and/or shown herein as distinct from one another may be physically or functionally combined where appropriate.

15 In short, the present specification has been set forth with reference to preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the present specification. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the

20 equivalents thereof.

What is claimed is:

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